REMARKS

This Amendment is being filed in response to the final Office Action dated October 15, 2008. No new matter or considerations are introduced by this amendment, as this amendment merely corrects informalities. For the following reasons this amendment should entered, the application allowed, and the case passed to issue. In the event that this application is not allowed, this Amendment should be entered as it reduces the issues on appeal.

Claims 3-5 are pending in this application. Claims 3-5 were rejected. Claim 3 has been amended in this response. Claims 1 and 2 were previously canceled.

Objections to the Specification

The specification is objected to because it is unclear whether there are two different batteries supplying two different types of outputs and it is unclear why one output is an external parameter while the other is an internal parameter.

This objection is traversed and reconsideration and withdrawal thereof respectfully requested.

As explained in the specification, the "battery output for a smoothened output of power generation" is an output required by the redox flow battery in order for the generation power of a wind power generator, for example, to reach a smoothened target output (output of wind power generator + output of redox flow battery). The "specified output" is a rated output, which is determined at the time of designing the redox flow battery. Accordingly, there is no discrepancy in the specification as the former is the output that changes due to the output of the wind power generator while the latter is a fixed value in the design phase.

As to whether there are two different batteries supplying two different types of outputs, claim 3 has been amended to clarify that the specified battery output is the specified output of the redox flow battery.

Applicants submit that the specification is clear to one of ordinary skill in this art.

Claim Rejections Under 35 U.S.C. § 112

Claim 3 was rejected under 35 U.S.C. § 112, second paragraph, as being indefinite because it is allegedly unclear what parameters fall under the categories of external and internal in claim 3. This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested.

Claim 3 has been amended to further clarify the claim and to specify that the specified output of the battery is that of the redox flow battery. In view of the amendment and the explanation above, Applicants submit that the claims fully comport with the requirements of 35 U.S.C. § 112.

Claim Rejections Under 35 U.S.C. § 103

Claims 3-5 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Hasegawa et al. (US 2001/0012211) in view of Oga et al. (JP 2000-073932) and Clarke et al. (WO 03/017407). This rejection is traversed, and reconsideration and withdrawal thereof respectfully requested. The following is a comparison between the present invention, as claimed, and the cited prior art.

An aspect of the invention, per claim 3, is a method of designing a redox flow battery system comprising the steps of determining an average value of output distribution of the redox flow battery for smoothing an output of power generation of generating equipment that varies irregularly in output of power generation, and a standard deviation, and determining at least one

of a specified output of the redox flow battery, number of the batteries, specified output of the DC/AC converter for converting the battery output, and number of the DC/AC converters for converting the battery output, based on the average value and the standard deviation.

The Office Action asserted that Hasegawa et al. teach a method of designing a rechargeable battery system comprising a rechargeable battery but is silent as to using averages and standard deviations; and redox flow batteries. The Office Action relied on the teaching of Oga et al. of determining an average value of variables of generator output and using the standard deviation value to determine the optimum value of electric power. Clarke et al. is relied on for teaching a rechargeable cerium zinc oxide redox flow battery.

When "the generating equipment varies irregularly in output of power generation" is taken as wind power generation in the present invention, an average value and standard deviation of the difference between a smoothened target output distribution (output of wind power generation + output of redox flow battery) and an output distribution of the wind power generation is determined. At least one of a specified output (rated output) of the redox flow battery to be combined with the wind power generator, number of batteries, a specified output of DC/AC converter for converting battery output, and number of DC/AC converters for converting the battery output is determined, based on the average value and the standard deviation.

According to the present invention, a magnitude of the redox flow battery that reflects practical use (intended use) of the redox flow battery can be determined based on the standard deviation of "output of the redox flow battery that smoothes output of power generation of the generating equipment, which varies irregularly in target output distribution (output of wind power generator + output of redox flow battery) and output of wind power generator."

Hasegawa et al., Oga et al., and Clarke et al., whether taken in combination, or taken alone, do not suggest the claimed method of designing a redox flow battery because Hasegawa et al., Oga et al., and Clarke et al. do not suggest the steps of determining an average value of output distribution of the redox flow battery for smoothing an output of power generation of generating equipment that varies irregularly in output of power generation, and a standard deviation, and determining at least one of a specified output of the redox flow battery, the number of batteries, specified output of the DC/AC converter for converting the battery output, and number of the DC/AC converters for converting the battery output, based on the average value and the standard deviation, as required by claim 3.

Hasegawa et al. provide a rechargeable battery system between power generation equipment and a power system consuming power. Hasegawa et al. disclose a technique to control an active power and a reactive power that are output from the rechargeable battery system in order to stabilize load fluctuations in a customer's equipment and significant fluctuations in the power generation equipment. A power system stabilization system employing the rechargeable battery system of Hasegawa includes a detection circuit detecting a difference between the current state and a predetermined active power and reactive power, which should be held by a power system connecting the power generation equipment and the power system consuming power together. The rechargeable battery system controls its output in correspondence with the detected results. See Hasegawa et al. paragraphs [0012] and [0013].

Accordingly, the technique disclosed in Hasegawa et al. defines a method for controlling the active power and the reactive power from the rechargeable battery system in order to stabilize load fluctuations in the power system. Hasegawa et al. do <u>not</u> disclose a technique for

determining the optimum scale of the rechargeable battery system that is coupled to the power generation equipment.

Oga et al. do not cure the deficiencies of Hasegawa et al. Oga et al. is related to wind power generating equipment in which a NaS battery and a charging and discharging device are provided. The NaS battery of the Oga et al. has (1) an instantaneous capacity at 1-2 times the standard deviation value of the generated output obtained on the basis of the wind power generating equipment, and (2) a charging and discharging time capacity of 4-8 hours. The charging and discharging device charges and discharges electricity using the NaS battery. Oga et al. teach that fluctuation of the generated output of the wind power generating equipment can be compensated, regardless of a change of wind speed. Because the invention of Oga et al, employs wind power that is irregular and unsettled as power source, total output through a year of wind power generator is statistically observed and a variations from the average output value is obtained. On the basis of this variation, the capability of the NaS battery is determined. Furthermore, the NaS battery having a capability to generate substantially equal output to the variation obtained in that way is combined with the wind power generating equipment. Thus, Oga et al. determine the capability of the NaS battery on the basis of the variation in output of wind power generator, which is statistically calculated.

On the other hand, in the present invention, the optimum scale of the redox flow battery combined to the power generator is <u>not</u> determined based on the variation in the statistically calculated output of wind power generator, but rather is determined from a variation in the statistically calculated required output of <u>the redox flow battery itself</u>.

Differences in between Oga et al. and the present invention are explained with the specific examples below.

Fig. A (Case applied to D3, D4)

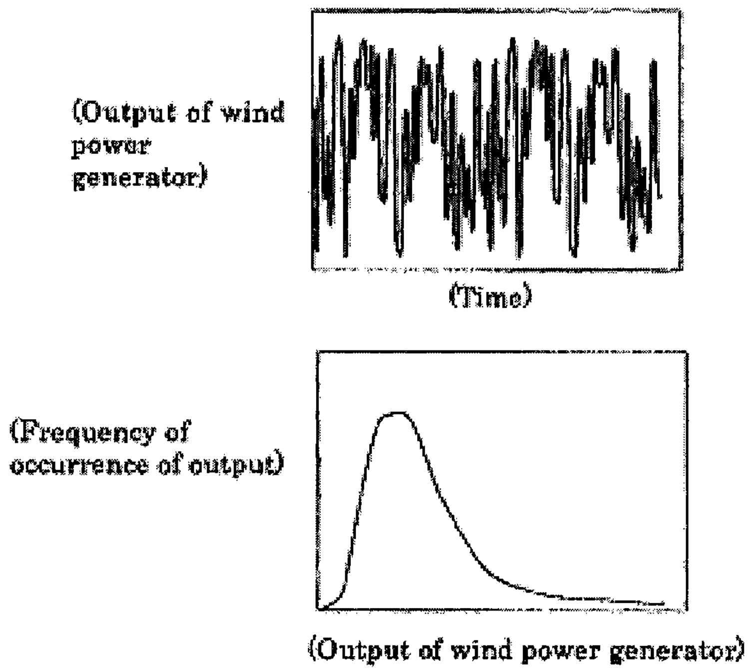
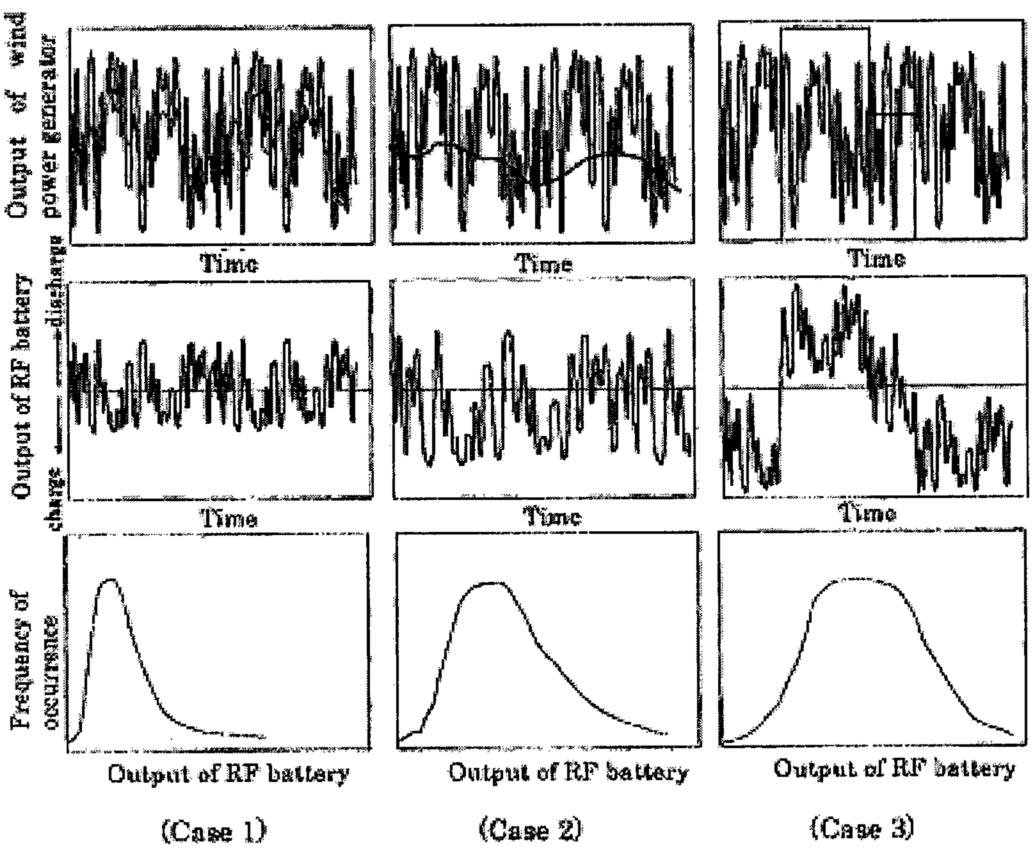


Fig. A shows an example of the output of the wind power generator and frequency of occurrence of output of the wind power generator. When the technique of Oga et al. is used, the standard deviation is obtained from the characteristics of the frequency of occurrence of output, and then, the output of NaS battery is determined based on this single factor. See Oga et al., paragraph 0014 and Fig. 3.

Fig. B below shows the technique of the present invention. The examples of output of wind power generator are the same as Fig. A above.

Fig. B (Explanation drawing related to the present invention)



Case 1 and Case 3 illustrate when the redox flow batteries work for stabilizing or smooth the output of the battery system when the redox flow battery is combined to the wind power generator. Reference curves shown in the first row in the images show the output of the battery system to be achieved when smoothing the output (total output of the wind power generator plus redox flow battery).

In Case 1, the output of the battery system is smoothened over a short period (intended use of the redox flow battery: smoothing output),

in Case 2, the output of the battery system is smoothened over a long period (intended use of the redox flow battery: smoothing output); and

in Case 3, the total output of wind power generator plus redox flow battery is generated as a predetermined pattern (intended use of the redox flow battery: equalizing of load). In case 3, the redox flow battery absorbs the total output of the wind power generator in the nighttime while generating output in the daytime so as to make the total output of the wind power generator plus the redox flow battery the desired pattern.

Images in the second row show the required output discharged from the redox flow battery (= desired output (reference curve) – actual output of wind power generator).

Images in the third row show the frequencies of occurrence of the output of the redox flow battery.

As clearly illustrated in these Figures, the required output is different in each case when the intended use of the redox flow battery is different. In Fig. B, a greater magnitude of output is required in the order: Case 1 → Case 2 → Case 3. Similarly, variations in output swing in a wider range in the order: Case 1 → Case 2 → Case 3. That is, if the wind power generator is combined to the redox flow battery, the optimum scale of the redox flow battery is changed by its practical use. In other words, the method of Oga et al. is unable to design the optimum scale of the redox flow battery because only a single factor (output of wind power generator) is considered to determine the scale or the magnitude of output of the NaS battery. To the contrary, in the present invention, the redox flow battery is designed based not on the variation in wind power generator output, but the variation in the required output of the redox flow battery. Therefore, the present invention allows the optimum scale of the redox flow battery suitable for the specific practical use to be designed.

In both Case 1 and Case 2, output of wind power generator with the same output distribution is smoothened, however, the two cases are different in their target output patterns.

Case 1 aims to smooth output of wind power generator in a shorter period while Case 2 aims to smooth output of wind power generator in a longer period. hence, it can be understood from Fig. B that the required output variable range of the redox flow battery is changed by the target output pattern, even in the same wind power generator, and the optimum magnitude of the redox flow battery is changed accordingly.

As noted in the following paragraph, the target output patterns can be arbitrarily selected in the present invention (page 10, lines 8-22 of the present specification):

> The ph[r]ase of "smoothing the output of power generation" used herein is intended to mean that when an output of power generation exceeds a threshold as is preset for the output of power generation, the surplus output exceeding the threshold is charged in the battery, while on the other hand, when an output of power generation is less than the threshold, the output corresponding to the shortage is discharged from the battery. Also, the ph[r]ase of "smoothing the power consumption" used herein is intended to mean that when power consumption exceeds a threshold as is also preset for the power consumption, the output corresponding to the shortage caused by the power consumption exceeding the threshold is discharged from the battery, while on the other hand, when power consumption is less than the threshold, the surplus output is charged in the battery. The same or different thresholds may be used for charging and discharging the battery. Also, the thresholds may be varied depending on the time required for the power generation and the output situation thereof.

It is especially clear that the target output pattern can be selected at the user's option from the description, "the thresholds may be varied depending on the time required for the power generation and the output situation thereof."

As explained above, according to Oga et al., a designer cannot select how to stabilize or smoothen the variation in output of the wind power generator by the NaS battery. The designer is merely able to design a NaS battery based on a single factor, that is, the variation in output of the wind power generator. In short, the "output of NaS battery" corresponds to the "variation in the output of the wind power generator" only. Accordingly, a NaS battery suitable for practical use cannot be designed.

On the other hand, the method of the present invention can design the redox flow battery with an optimum scale suitable for the practical use, (smoothing output, equalization of load, countermeasure to voltage sag, etc.) when combined with a wind power generator or the like to stabilize or smoothen the output of wind power generator. Therefore, the method of the present invention is superior in capability for use in a wide-range of applications. Thus, the method of the present invention is completely different from Oga et al. and achieves superior results.

Oga et al. teach (paragraph [0014] and Fig. 3:

(1) Determining an average value and a standard deviation of wind speed from wind speed distribution.

(2) Determining output L of wind power generator corresponding to the wind speed of [the average value + the standard deviation].

(3) Determining output H of wind power generator corresponding to the wind speed of [the average value + double the standard deviation].

(4) Determining output A of wind power generator corresponding to the wind speed of [the average value].

(5) Adopt a NaS battery which has the instant capacity of [output L · output A] ~ [output H · output A].

(6) Select the discharge duration of the battery to 4 to 8 hours, which correspond to the average change cycle of weather.

According to Oga et al., the instant capacity of the NaS battery is principally determined on the basis of only the standard deviation of wind power generation variables. Oga et al. do not consider combining the NaS battery with the wind power generator and selecting a pattern of smoothened target output (output of wind power generator + output of Na S battery). That is,

Oga et al. do not suggest a means of determining an optimum magnitude of the rechargeable battery (the redox flow battery in the present application) in accordance with the pattern of the smoothened target output.

Clarke et al. do not cure the deficiencies of Oga et al. and Hasegawa et al. Clarke et al. disclose load leveling batteries that employ a redox flow battery in which an electrolyte includes a cerium-zinc redox pair, and the reduction of cerium and oxidation of zinc produce current provided by the battery. In other words, the technique disclosed in Clarke et al. indicate that a redox flow battery is effective to level a load. Clarke et al. do not suggest which information should be obtained and considered to determine the optimum scale of the redox flow battery when the battery is combined to a power generator that is irregular and unsettled, such as a wind power generator.

As explained above, there are clear differences between the present invention and the cited references. Additionally, the present invention achieves remarkable working results, which cannot be achieved in the cited references. Therefore, the present invention is clearly unobvious in view of the of the combination of the cited references.

In contrast to the teachings of the cited references, the present invention is related to the method of designing the redox flow battery system to determine the optimum magnitude of the redox flow battery which is to be combined with the wind power generator or the like. What the present method determines is not the smoothened target output (output of wind power generator + output of redox flow battery) or the power generated from existing redox flow battery system, but the specified output of the redox flow battery as a technical specification, that is, rated output.

The Examiner maintained that Applicant argues the references individually. Nevertheless, the invention of Oga et al. does not make it possible to determine the optimum magnitude of the redox flow battery system corresponding to the pattern of the smoothened target output as desired by the user of the redox flow battery system. Also, the invention of Hasegawa et al. is not directed to determining a magnitude (e.g. specified output (rated output)) of the redox flow battery, but it is rather directed to a mans of operating an existing redox flow battery system. Accordingly, the present invention is clearly unobvious in view of the combination of the cited references.

Obviousness can be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either explicitly or implicitly in the references themselves or in the knowledge readily available to one of ordinary skill in the art. *In re Kahn*, 441 F.3d 977, 986, 78 USPQ2d 1329, 1335 (Fed. Cir. 2006); *In re Kotzab*, 217 F.3d 1365, 1370 55 USPQ2d 1313, 1317 (Fed. Cir. 2000); *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). There is no suggestion in Hasegawa et al., Oga et al., or Clarke et al. to modify the method of Hasegawa et al. to include the steps of determining an average value of output distribution of the redox flow battery for smoothing an output of power generation of generating equipment that varies irregularly in output of power generation, and a standard deviation, and determining at least one of a specified output of the redox flow battery, the number of batteries, specified output of the DC/AC converter for converting the battery output, and number of the DC/AC converters for converting the battery output, based on the average value and the standard deviation, as required by claim 3, nor does common sense dictate such a modification. The Examiner has not provided any evidence that there would be any

obvious benefit in making such a modification of Hasegawa et al. *See KSR Int'l Co. v. Teleflex, Inc.*, 500 U.S. ____ (No. 04-1350, April 30, 2007) at 20.

The only teaching of the claimed method of designing a redox flow battery is found in Applicants' disclosure. However, the teaching or suggestion to make a claimed combination and the reasonable expectation of success must and not be based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The dependent claims are allowable for at least the same reasons as claim 3 and further distinguish the claimed method.

In view of the above amendment and remarks, Applicants submit that this amendment should be entered, the case allowed, and passed to issue. If there are any questions regarding this Amendment or the application in general, a telephone call to the undersigned would be appreciated to expedite the prosecution of the application.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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